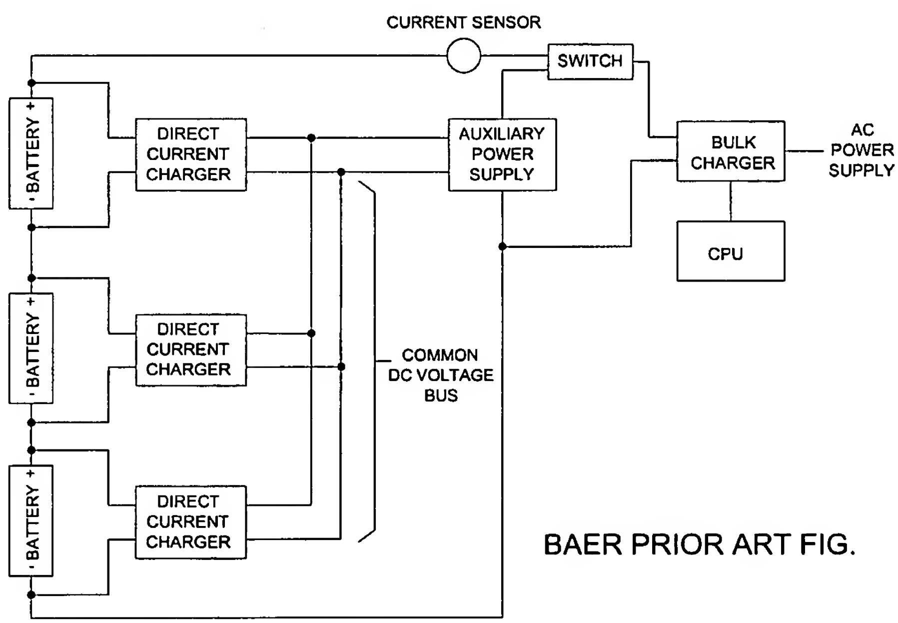
REMARKS/ARGUMENTS

Claims 1–27 are pending in the application.

Claims 1-27 were rejected under 35 U.S.C. 102(b) as being anticipated by Baer et al. (USP 5,701,068) with reference to FIG. 1 and the abstract of BAER.

BAER Prior Art

BAER discloses a battery management system for a plurality of batteries connected in series. The system is directed to a battery pack that includes a plurality of series-connected batteries that are installed in, and provide power to, an electric vehicle (col. 3, lines 1-4).



BAER PRIOR ART FIG.

Referring to the above figure, which is a simplified diagram of BAER FIG. 1, BAER discloses a bulk charger 80 connected across all of a plurality of the series-connected batteries 50 (three in this example). The bulk charger has an ac power input (ac power supply 110) and dc output connected across all of a plurality of the series-connected batteries. A separate direct current (dc) charger 70 is connected across each one of the batteries. A single auxiliary (dc) power supply 120 (also identified as a dc-to-dc

converter) supplies dc power to each one of the individual dc chargers via a common voltage bus 130. The bulk charger also supplies dc input power to the auxiliary dc power supply. A control switch 90 controls charging current from the bulk charger and individual dc chargers to the plurality of batteries connected in series. Current sensor 100 senses charging current from only the bulk charger.

For control, CPU 20 controls the operation of the bulk charger (col. 3, lines 45-51). The CPU also controls the operation of control switch 90. Control of switch 90 by the CPU provides three operating states: (1) charging mode with the bulk charger and all individual dc chargers; (2) charging mode with all of the individual dc chargers and not the bulk charger; and (3) idle or discharge mode when the batteries are not being charged (col. 3, line 53 to col. 4, line 6. The CPU also monitors and controls each of the series connected batteries via components in a battery module 30, which contains a battery, battery node 60 and a dc charger. Sensed parameters for each battery are battery temperature (col. 5, lines 18 to 35) and battery terminal voltage (col. 5, lines 46 to 55). Current sensor 100 provides a signal to the CPU that represents charging current from only the bulk charger (col. 4, lines 7 to 9).

Each of the dc chargers (alternatively identified as DC/DC converter 210) provides charging current to a battery that is a small percentage of the discharge capacity of each battery.

The CPU executes a battery management system main program (BAER FIG. 9a and FIG. 9b; col. 12, line 16 to col. 14, line 28). In idle mode CPU program execution can turn on a dc charger associated with a battery having low battery terminal voltage to recharge it (col. 12, lines 44 to 49). For a battery high terminal voltage condition, CPU program execution controls the charging output of the bulk charger and individual dc chargers in a sequenced manner (col. 13, lines 27 to 67). For a sensed low battery temperature condition, CPU program execution disconnects the bulk charger and turns off all individual chargers (col. 14, lines 1 to 7). For a sensed high battery temperature condition, CPU program execution disconnects the bulk charger and turns off the individual charger associated with battery operating at high temperature (col. 14, lines 8 to 16). If one of the plurality of batteries is fully charged, CPU program execution disconnects the bulk charger current from all of the series-connected batteries and turns

of the dc charger associated with the fully charged battery (col. 14, lines 17 to 23). The CPU also executes a one second interrupt program that checks the status of each battery every second (col. 14, line 29 to col. 16, line 34).

The CPU main program controls battery charging in three phases: (1) bulk charger only until a predetermined battery voltage level is achieved; then there is a combination of battery charging from the bulk charger and individual dc chargers (col. 26, lines 37 to col. 27, line 20); (2) battery charging with the individual dc battery chargers (col. 27, lines 21 to 54); and (3) individual dc battery chargers maintain each of the series-connected batteries at full charge (col. 27, line 56 to col. 28, line 21). BAER discloses that the individual dc battery chargers could be left out of the battery module; in that configuration, the bulk charger charges all of the batteries in series (col. 29, lines 53 to 60).

<u>Rejection of claims 1 to 27 as being anticipated by BAER</u>

To anticipate a claim of the present application BAER must teach or disclose each of the claimed elements. As discussed above, BAER discloses a dc battery charging system for a plurality of series-connected batteries in an electric vehicle wherein a CPU controls battery charging schemes between a single bulk dc battery charger connected across all of the plurality of series-connected batteries and a plurality of individual dc chargers (DC/DC converters), each one of which is connected across one of the batteries in the series. In the claims in the present invention, the batteries are located in a plurality of battery-powered computers. AC utility power to the plurality of battery-powered computers is selectively switched to groups of the battery-powered computers. In the pending claims, ac utility power is selectively supplied to the groups of battery-powered computers to charge batteries located in the computers (or batteries removed from the computer in some claims). Unlike BAER, in the pending claims: the batteries are not connected in series; no outputs of dc chargers are controlled by sensing battery temperature or voltage; ac power is switched among groups of battery-powered computers (or batteries removed from the computers in some claims) without sensing battery temperature or voltage; and control of a bulk charging source and individual charging sources is not done.

The apparatus of claim 1 includes a plurality of electrical bus elements (e.g. elements

25, 26 and 27 in FIG. 1) for connecting a plurality of battery-powered computers (e.g. element 30 in FIG. 1) to the apparatus. The plurality of battery-powered computers are distributively connected to the plurality of electrical bus elements to form a group of battery-powered computers (e.g. elements 31, 32 and 33 in FIG. 1) that is connected to each one of the plurality of electrical bus elements. A plurality of switching elements (e.g. elements 14, 16 and 19 in FIG. 1) connects the plurality of battery-powered computers to the apparatus. Each one of the plurality of switching elements has a load terminal exclusively connected to one of the plurality of electrical bus elements. An ac power source (e.g. UTILITY POWER SOURCE in FIG. 1) is connected to a line terminal of each one of the plurality of switching elements. The ac power source has a limited current capacity that is generally less than a total maximum charging current for all of the plurality of battery-powered computers. A means of controlling the plurality of switching elements (e.g. element 12 in FIG. 1) is provided so that the ac power source is selectively connected to the plurality of electrical bus elements to recharge the one or more internal batteries without exceeding the limited current capacity of the ac power source. BAER does not teach connecting batteries to a plurality of bus elements; BAER uses a single common dc bus to connect to a plurality of dc chargers to an auxiliary power supply. BAER does not teach limiting the current capacity from the ac power source that is providing power for selectively charging groups of batteries.

The apparatus of claim 2 includes all of the features of the apparatus of claim 1, and the means of controlling the plurality of switching elements also includes a means of exclusive sequential closure of an each one of the plurality of switching elements for a period of time sufficient to recharge the one or more internal batteries for the group of battery-powered computers connected to the each one of the plurality of switching elements. BAER does not teach sequential switch closure as a means of charging groups of battery-powered computers.

The apparatus of claim 3 includes all of the features of the apparatus of claim 1, and the means of controlling the plurality of switching elements further comprises a means of exclusive simultaneous closure of two or more of the plurality of switching elements for a period of time sufficient to recharge the internal batteries for the groups of battery-powered computers connected to the two or more of the plurality of switching elements.

BAER does not teach simultaneous charging of multiple groups of battery-powered computers.

The apparatus of claim 4 includes all of the features of the apparatus of claim 1, and the means of controlling the plurality of switching elements further comprises an i/o device having an output to each one of the plurality of switching elements to independently open and close each one of the plurality of switching elements. The i/o device has an input from a computer whereby the computer executes a program to send commands to the i/o device to selectively open and close each one of the plurality of switching elements. BAER does not teach using an i/o device to independently open and close the plurality of switching elements of claim 1 via a computer executed program.

The apparatus of claim 5 includes all of the features of the apparatus of claim 1, and an ac-to-dc rectifier connected between at least one of the plurality of electrical bus elements and an at least one of the plurality of battery-powered computers (e.g., element 35 in FIG. 1) to supply dc current to at least one of the plurality of battery-powered computers. BAER does not teach use of an ac-to-dc rectifier between an electrical bus element and a battery-powered computer to charge each group of computers as recited in claim 1.

The apparatus of claim 6 includes all of the features of the apparatus of claim 1, and one or more ac-to-dc battery chargers. Each of the one or more ac-to-dc battery chargers has an ac input and a dc output. The ac input of each of the one or more ac-to-dc battery chargers is connected to the load terminal of at least one of the plurality of switching elements, and the dc output of each one of the one or more ac-to-dc battery chargers is connected to at least one receptacle suitably configured to connect to and recharge one or more batteries removed from the plurality of battery-powered computers. BAER does not teach use of an ac-to-dc rectifier with an ac input connected to one of the plurality of switching elements of claim 1 and a dc output connected to a receptacle suitable for recharging a battery removed from a battery-powered computer.

The apparatus of claim 7 includes all of the features of the apparatus of claim 1, and at least one ac-to-dc rectifier having an ac input and a dc output. The ac input is connected to the load terminal of at least one of the plurality of switching elements of claim 1 and the dc output is connected to at least one of the plurality of electrical bus

elements of claim 1, whereby the at least one ac-to-dc rectifier supplies dc current to the plurality of battery-powered computers connected to at least one of the plurality of electrical bus elements. BAER does not teach use of an ac-to-dc rectifier with an ac input connected to one of the plurality of switching elements of claim 1 and a dc output connected to an electrical bus element of claim 1.

The apparatus of claim 8 includes all of the features of the apparatus of claim 7, and a means for alternatively connecting each one of the plurality of battery-powered computers connected to at least one of the plurality of electrical bus elements either to an electrical load, or to the at least one of the plurality of electrical bus elements connected to the dc output of the at least one ac-to-dc rectifier. BAER does not teach a means for alternatively connecting each one of a plurality of battery-powered computers connected to at least one of the plurality of battery-powered computers connected to at least one of the plurality of electrical bus elements of claim 1 either to (1) an electrical load or (2) at least one of the plurality of electrical bus elements connected to the dc output of the at least one ac-to-dc rectifier of claim 7.

The method of claim 9 includes the steps of: (1) connecting a line terminal of a plurality of switching elements to an ac power source of a limited current capacity; (2) connecting a load terminal of each one of the plurality of switching elements to one of a plurality of electrical bus elements; (3) distributively connecting the plurality of battery-powered computers to the plurality of electrical bus elements; and (4) controlling the plurality of switching elements to selectively supply a current from the ac power source to the plurality of electrical bus elements to recharge the one or more internal batteries for the plurality of battery-powered computers without exceeding the limited current capacity of the ac power source. BAER does not teach connecting the line terminal of a plurality of switching elements to an ac power source; in BAER the ac power source is connected exclusively to the bulk charger. BAER does not teach connecting a load terminal of each one of the plurality of switching elements to one of a plurality of electrical bus elements; BAER teaches a single switch that controls dc charging current from the bulk charger and dc power to the auxiliary power supply. BAER does not teach distributively connecting a plurality of battery-powered computers to the plurality of electrical bus elements; BAER connects all batteries in series; the bulk

charger is connected across this total series connection and the individual dc chargers are connected across each battery. BAER does not teach controlling the plurality of switching elements to selectively supply a current from the ac power source to the plurality of electrical bus elements to recharge the one or more internal batteries for the plurality of battery-powered computers; BAER selectively controls dc charging power from the bulk charger and individual dc chargers to charge batteries.

The method of claim 10 includes all of the steps of claim 9, and connecting an ac to-dc rectifier between at least one of the plurality of electrical bus elements and at least one of the plurality of battery-powered computers connected to the at least one of the plurality of electrical bus elements to supply dc current to the at least one of the plurality of battery-powered computers. BAER does not teach connecting an ac-to-dc rectifier between at least one of the plurality of electrical bus elements of claim 9 and at least one of the plurality of battery-powered computers connected to the at least one of the plurality of electrical bus elements to supply dc current to the at least one of the plurality of battery-powered computers.

The method of claim 11 includes all of the steps of claim 9, and sequentially closing each one of the plurality of switching elements for a period of time sufficient to recharge the one or more internal batteries for a group of battery-powered computers that are connected to each one of the plurality of electrical bus elements connected to each one of the plurality of switching elements. BAER does not teach sequentially closing each one of the plurality of switching elements of claim 9 for a period of time sufficient to recharge the one or more internal batteries for a group of battery-powered computers connected to each one of the plurality of electrical bus elements of claim 9 that are connected to the each one of the plurality of switching elements.

The method of claim 12 includes all of the steps of claim 9, and closing, at the same time, two or more of the plurality of switching elements for a period of time sufficient to recharge the one or more internal batteries for a group of battery powered computers connected to two or more of the plurality of electrical bus elements that are connected to the two or more of the plurality of switching elements. BAER does not teach closing, at the same time, two or more of the plurality of switching elements of claim 9 for a period of time sufficient to recharge the one or more internal batteries for a group of

battery-powered computers connected to two or more of the plurality of electrical bus elements of claim 9 that are connected to two or more of the plurality of switching elements.

The method of claim 13 includes all of the steps of claim 9, and: (1) connecting an ac input of an ac-to-dc battery charger to an at least one of the plurality of electrical bus elements; (2) connecting an at least one battery removed from the plurality of battery-powered computers to a dc output of the ac-to-dc battery charger; and (3) recharging the at least one battery by the supply of dc current from the ac-to-dc rectifier. BAER does not teach connecting an ac input of an ac-to-dc battery charger to an at least one of the plurality of electrical bus elements of claim 9; connecting an at least one battery removed from the plurality of battery-powered computers to a dc output of the ac-to-dc battery charger; and recharging the at least one battery by the supply of dc current from the ac-to-dc rectifier.

The method of claim 14 includes all of the steps of claim 13, and alternatively connecting at least one of the plurality of battery-powered computers to either (1) an electrical load or (2) to the at least one of the plurality of electrical bus elements connected to the dc output of the ac-to-dc battery charger. BAER does not teach alternatively connecting at least one of a plurality of battery-powered computers to either an electrical load or to at least one of the plurality of electrical bus elements of claim 9 that is connected to the dc output of the ac-to-dc battery charger.

The method of claim 15 includes all the steps of claim 9 and: (1) connecting an ac input of an ac-to-dc rectifier to the load terminal of one of the plurality of switching elements; and (2) connecting a dc output of the ac-to-dc rectifier to a one of the plurality of electrical bus elements. BAER does not teach connecting an ac input of an ac-to-dc rectifier to the load terminal of one of the plurality of switching elements of claim 9; and connecting the dc output of the ac-to-dc rectifier to one of the plurality of electrical bus elements of claim 9.

The apparatus of claim 16 comprises an enclosure (e.g. element 40 in FIG. 2) and storage area (e.g. element 41 in FIG. 2). The enclosure houses: (1) a plurality of electrical bus elements for distributive connection of a plurality of battery-powered computers; (2) a plurality of switching elements; each one of the plurality of switching

elements has a load terminal exclusively connected to each one of the plurality of electrical bus elements; (3) a power terminal for connection to an external ac power source; the power terminal is connected to a line terminal of each one of plurality of switching elements; and (4) one or more control devices to control the opening and closing of the plurality of switching elements. BAER discloses a battery and battery charging equipment for an electric vehicle; BAER does not disclose an enclosure and storage area wherein the enclosure houses: a plurality of electrical bus elements for distributive connection of a plurality of battery-powered computers; a plurality of switching elements, with each one of the plurality of switching elements having a load terminal exclusively connected to each one of the plurality of electrical bus elements; a power terminal for connection to an external ac power source, with the power terminal connected to a line terminal of each one of plurality of switching elements; and one or more control devices to control the opening and closing of the plurality of switching elements.

The apparatus of claim 17 includes all of the features of the apparatus of claim 16, wherein the storage area is physically isolated from the interior of the enclosure and a plurality of ac power conductors pass through a conduit between the interior of the enclosure and the storage area. Each of the plurality of ac power conductors connect one of the plurality of battery-powered computers to one of the plurality of electrical bus elements. BAER does not disclose a storage area that is physically isolated from the interior of an enclosure, and a plurality of ac power conductors passing through a conduit between the interior of the enclosure and the storage area, with each of the plurality of ac power conductors connected to one of a plurality of battery-powered computers to one of the plurality of electrical bus elements.

The apparatus of claim 18 includes all of the features of the apparatus of claim 17, and a plurality of ac-to-dc rectifiers situated in the enclosure. The ac input of each of the plurality of ac-to-dc rectifiers is connected to one of the plurality of electrical bus elements. A plurality of dc power conductors pass through conduit between the interior of the enclosure and the storage area, and each one of the plurality of dc power conductors connects one of the plurality of battery-powered computers to a dc output of one of the plurality of ac-to-dc battery chargers. BAER does not disclose a plurality of

ac-to-dc rectifiers situated in the enclosure of claim 16.

The apparatus of claim 19 includes all of the features of the apparatus of claim 16 and, one or ac-to-dc battery chargers. The ac input of each one of the one or more ac-to-dc battery chargers is connected to the load terminal of at least one of the plurality of switching elements and a dc output of each one of the one or more ac-to-dc battery chargers is connected to one or more receptacles suitably configured to connect to, and recharge, a one or more a batteries removed from the plurality of battery-powered computers. The one or more receptacles are located external to the enclosure. BAER does not disclose one or more ac-to-dc battery chargers situated in the enclosure of claim 16.

The apparatus of claim 20 includes all of the features of the apparatus of claim 16, and at least one ac-to-dc rectifier situated in the enclosure. An ac input of each at least one ac-to-dc rectifier is connected to the load terminal of one of the plurality of switching elements, and a dc output of each at least one ac-to-dc rectifier is connected to one of the at least one of the plurality of electrical bus elements. BAER does not disclose at least one ac-to-dc rectifier situated in the enclosure of claim 16.

The apparatus of claim 21 includes a plurality of electrical bus elements for connecting the plurality of battery-powered computers to the apparatus. The plurality of battery-powered computers are distributively connected to the plurality of electrical bus elements to form a group of battery-powered computers connected to each one of the plurality of electrical bus elements. The plurality of electrical bus elements are arranged in two or more charging priority circuits for sequential priority charging of the plurality of battery-powered computers that are connected to each of the plurality of electrical bus elements. A timer (e.g. element 70 in FIG. 3) has a timer switching element controlled by the timer to close and open at selected times, and line and load terminals. An ac power source having a limited current capacity generally less than a total maximum charging current for all of the plurality of battery-powered computers is connected to the line terminal of the timer switching element to provide a supply current. A plurality of group charging current sensing devices (e.g. elements 72 and 73 in FIG. 3) is provided, with each one of the plurality of group charging current sensing devices controlling the opening and closing of an associated group charging current switching device (e.g.

elements CS2 and CS3 in FIG. 3). Each one of the plurality of group charging current sensing devices exclusively senses a group charging current provided by the supply current in one of the two or more charging priority circuits. The associated group charging current switching device is disposed in a next charging priority circuit of the two or more charging priority circuits, whereby when the each one of the plurality of group charging current sensing devices senses a selected value of the group charging current that is equal to or less than the limited current capacity of the ac power. The associated group charging current switching device closes to provide the supply current to the next charging priority circuit. BAER teaches dc charging current sensing from only the bulk charger. BAER does not teach use of a timer switch to control ac power for charging of battery-powered computers. BAER does not teach ac current sensing of ac power for charging selective groups of battery-powered computers with priority as recited in claim 21.

The apparatus of claim 22 includes all of the features of the apparatus of claim 21, and a main current sensing device (e.g. element 71 in FIG. 3) associated with a main current switching element controlled by the main current sensing device of claim 21. The main current sensing device is connected in series with the timer switching element to sense a total connected ac charging current for all of the plurality of battery-powered computers, whereby the main current switching element closes when the main current sensing device senses a current at or above a selected value. BAER does not disclose use of a main current sensing device to sense and control ac current for charging groups of battery-powered computers as disclosed in claim 22.

The apparatus of claim 23 includes a plurality of electrical bus elements for connecting the plurality of battery-powered computers to the apparatus. The plurality of battery-powered computers are distributively connected to the plurality of electrical bus elements to form a group of battery-powered computers connected to each one of the plurality of electrical bus elements. There is a plurality of switching elements, with each one of the plurality of switching elements having a load terminal exclusively connected to one of the plurality of electrical bus elements, An ac power source having a limited current capacity generally less than a total maximum charging current for all of the plurality of battery-powered computers is connected to a line terminal of each one of the

plurality of switching elements. A controller (e.g. element 12 in FIG. 4) has an output to each one of the plurality of switching elements to individually open or close each one of the plurality of switching elements. There is a plurality of current sensing devices (e.g. element 28 in FIG. 4), with each current sensing device sensing the magnitude of a bus charging current to each one of the plurality of electrical bus elements, or the magnitude of a computer charging current from each one of the plurality of electrical bus elements to each one of the plurality of battery-powered computers. Each of the plurality of current sensing devices has an input to the controller that is proportional to the sensed magnitude of the bus charging current or the computer charging current, whereby the controller processes the input from all current sensing devices and selectively opens or closes the plurality of switching elements based upon the limited current capacity of the ac power source and the sensed bus or computer charging currents so that the limited current capacity of the ac power source is not exceeded. BAER does not each ac current sensing of ac power for charging selected groups of battery-powered computers as recited in claim 23.

The apparatus of claim 24 includes all of the features of the apparatus of claim 23, and a plurality of ac-to-dc rectifiers. Each one of the ac-to-dc rectifiers has an ac input connected to at least one of the plurality of electrical bus elements, and a dc output connected to at least one of the plurality of battery-powered computers to supply a dc current to the at least one of the plurality of battery-powered computers. BAER does not disclose a plurality of ac-to-dc rectifiers as recited in claim 24.

The apparatus of claim 25 includes all of the features of the apparatus of claim 24. and a plurality of dc current sensing devices. Each of the plurality of dc current sensing devices senses the magnitude of the dc current, and has an input to the controller that is proportional to the magnitude of the dc current to the at least one of the plurality of battery powered computers, whereby the controller processes the input from all of the plurality of current sensing devices and selectively opens or closes the plurality of switching elements based upon: (1) the limited current capacity of the ac power source, (2) the sum of the sensed magnitude of the bus charging current to each one of the plurality of electrical bus elements, and (3) the sum of the magnitude of the dc current to at least one of the plurality of battery powered computers so that the limited current

capacity of the ac power source is not exceeded. BAER does not disclose a plurality of dc current sensing devices as recited in claim 25.

The apparatus of claim 26 includes all of the features of the apparatus of claim 23, and a main current sensing device. The main current sensing device senses the magnitude of a total charging current for all of the plurality of battery-operated computers. The main current sensing device has an input to the controller that is proportional to the magnitude of the total charging current for all of the plurality of battery-operated computers, whereby the controller processes the input from the main current sensing device and opens all of the plurality of switching elements if the total charging current is equal to or greater than a selected value. BAER does not disclose a main current sensing device of claim 26.

The apparatus of claim 27 includes two or more stations for recharging the plurality of battery-powered computers and a means for communicating between a computer at each of the two or more stations whereby recharging of the one or more internal batteries in the battery-powered computers at each of the two or more stations is coordinated among all of the two or more stations. Each of the two or more stations includes: (1) a plurality of electrical bus elements for connecting a portion of the plurality of battery-powered computers to the apparatus; the portion of the plurality of battery-powered computers is distributively connected to the plurality of electrical bus elements to form a group of battery-powered computers connected to each one of the plurality of electrical bus elements; (2) a plurality of switching elements, with each one of the plurality of switching elements having a load terminal exclusively connected to each one of the plurality of electrical bus elements; (3) an ac power source having a limited current capacity generally less than a total maximum charging current for all of the plurality of battery-powered computers; the ac power source is connected to a line terminal of each one of the plurality of switching elements; (4) a means of controlling the plurality of switching elements; and (5) a computer for executing a program to send commands to the means of controlling to selectively open and close each one of the plurality of switching elements whereby the ac power source is selectively connected to the plurality of electrical bus elements to recharge the one or more internal batteries in the plurality of battery-powered computers without exceeding the limited current capacity of the ac

power source. BAER does not disclose multiple stations for recharging the internal batteries for a plurality of battery-powered computers and a means for communicating between a computer at each of the stations as disclosed in claim 27.

Applicants respectfully submit that, for the above reasons, the pending claims are not anticipated by BAER, and request allowance of all pending claims.

Respectfully submitted,

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